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FULL CONTENTS CLAIM + DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE

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Untranslatable words are replaced with asterisks (****).
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FULL CONTENTS

Claim(s)]
Claim 1] The desulfurization method of the hydrocarbon raw material for fuel cells characterized by making the devulcanizing agent which consists of copper, nickel, and zinc oxide which preceded reforming to the heating gas of a hydrogen principal component, and manufactured the hydrocarbon raw material by the coprecipitation method by the steam reforming reaction contact.

Detailed Description of the Invention]
0001]
Industrial Application] If this invention is said in more detail about the desulfurization method of the hydrocarbon raw material for fuel cells, It is related with the efficient desulfurization method of the hydrocarbon raw material which is the method which converts hydrocarbons into the heating gas of a hydrogen principal component by a steam reforming reaction at least, and is used very in favor of the fuel cell system using the obtained hydrogen as a fuel.
0002]
Description of the Prior Art] The fuel cell which uses hydrogen as a fuel is already put in practical use, and spread will be expected increasingly from now on. Hydrogen or hydrogen inclusion heating gas used for this fuel cell, Although it can obtain by various kinds of methods, as a general-purpose fuel cell system, the method of acquiring by [, such aserosene and naphtha,] carrying out steam reforming of this according to a suitable catalyst comparatively, using the hydrocarbons of **** as a raw material attracts attention. Moreover, it is since carbon monoxide etc. is generally generated besides hydrogen in the steam reforming reaction of hydrocarbons, While carrying out denaturation treatment of the product of this steam reforming reaction according to a still more suitable catalyst, making carbon monoxide react with water by a water gas shift reaction, changing into carbon dioxide and hydrogen and raising **** of hydrogen further It is harmful and, generally reducing the carbon monoxide which tends to cause [of a fuel cell electrode] activity lowering is also performed.

0003] Thus, the fuel cell system which uses the hydrocarbons possessing a steam-reforming means and a denaturation means as a raw material is developed, and the spread is advanced.

0004] Although various kinds of hydrocarbons (hydrocarbon inclusion gas and synthetic petroleum, such as natural gas and town gas etc.) including petroleum system hydrocarbons, such as LPG, naphtha, and kerosene, are usable as a hydrogen manufacture raw material by steam reforming in such a fuel cell system, for example In such a hydrocarbon raw material, the sulfur content of the concentration in which the thing of marketing beforehand desulfurized by hydrotreating is also still more remarkable is contained. For example, also in the case of kerosene (commercial desulfurization kerosene), sulfur content (several ppm - about 100 ppm) is usually contained. Also with an organosulfur compound, unless hydrotreating removes from a system also as hydrogen sulfide, this sulfur content serves as a catalyst poison of a steam reforming reaction catalyst or a denaturation catalyst, and has an adverse effect, such as reducing the activity of a fuel cell electrode.

0005] So, in the fuel cell system which uses such hydrocarbons as a raw material, it is an important technique for protection of a latter steam-reforming catalyst, a denaturation catalyst, and an electrode to fully remove the sulfur content in a raw material. In addition, as for sulfur content, it is desirable to usually decrease to 0.1 ppm or less in advance of a steam reforming reaction.

0006] It replaces with H₂S which remove the sulfur content in a raw material in such a fuel cell system and which carry out hydrotreating of the coal-for-coke-making-sized hydrogen according to a suitable desulfurization catalyst, and are easy to carry out adsorption treatment of the organosulfur compound as a method, and it seems that the way a suitable adsorbent removes this H₂S is effective. then, Co-Mo and nickel-Mo which are generally used widely as a hydrotreating catalyst etc. -- the method which removes the sulfur content in a raw material (an organosulfur compound and H₂S) can be considered combining these using a desulfurization catalyst, using zinc oxide as an adsorbent. However, since it is not effective and the above-mentioned devulcanizing agent using such a general hydrotreating catalyst of the desulfurization engine performance is inadequate if the hydrotreating itself does not make hydrogen pressure high voltage considerably, it is difficult to decrease to 0.1 ppm or less aiming at sulfur content. So, it is hard to apply such a devulcanizing agent to a fuel cell system and a general-purpose fuel cell system with specially as low operating pressure as an atmospheric pressure -10 kg/cm² G grade.

0007] Therefore, it has hydrotreating performance sufficient also with such low voltage, and the adsorption treatment performance of sulfur content, and it has been an important technical problem to develop the high devulcanizing agent of the desulfurizing ability force in which sulfur content can be efficiently reduced to 0.1 ppm or less.

0008] then -- taking such a point into consideration -- this invention persons -- as the devulcanizing agent of hydrocarbons -- ***** -- it inquired by investigating widely whether the thing [like] is proposed. As a result, it became clear that the conventional devulcanizing agent was inadequate for realizing the advanced desulfurization technique made into the object.

0009] For example, the devulcanizing agent of a nickel system is proposed by JP,H2-04301,A as a devulcanizing agent to kerosene. Although it is indicated that a Ni content adds Cu and uses zinc oxide as a carrier at 30 to 70% into the explanatory note, there is no concrete description of the concrete method of preparation of the devulcanizing agent, the desulfurization engine performance, etc.

0010] Moreover, they are a Cu-Zn system or Cu-Zn-Al₂O₃ as a devulcanizing agent [as proposed to town gas (13A), LPG, and full range naphtha in JP,H2-302302,A]. The thing of the system supposes that it is effective. However, the devulcanizing agent of these former of desulfurization results is inadequate.

0011] That is, when using a devulcanizing agent with such inadequate desulfurization engine performance for the above fuel cell systems, it is, Also in order to fully secure the activity and the lives of a catalyst, such as a latter steam-reforming catalyst, since it is necessary to use a devulcanizing agent so much, it is economically disadvantageous, and here were troubles, like miniaturization of a system is difficult and there is.

0012]

Problem(s) to be Solved by the Invention] The object of this invention develops the highly

efficient devulcanizing agent which can fully remove sulfur content from hydrocarbons efficiently also with low voltage comparatively. How to remove sulfur content from various kinds of hydrocarbon raw materials for fuel cells efficiently by using this devulcanizing agent, That is, it is in offering the efficient desulfurization method of the hydrocarbon raw material which is the method of converting hydrocarbons into the heating gas of a hydrogen principal component by a steam reforming reaction at least, and using very in favor of the fuel cell system using the obtained hydrogen as a fuel.

0013]

Means for Solving the Problem] This invention persons are devulcanizing agents () which consist of a specific component prepared with the specific method of preparation of a coprecipitation method, as a result of repeating investigation wholeheartedly that said object should be attained. Namely, by the devulcanizing agent which consists of copper, nickel, and zinc oxide being very effective as a devulcanizing agent of various kinds of hydrocarbon raw materials for fuel cells, such as kerosene, LPG, and naphtha, and using this It found out that clearance abatement of the sulfur content in this raw material could be easily carried out also by a comparatively low pressure even at the low concentration of 0.1 ppm or less. Then, desulfurization treatment of this hydrocarbon raw material for fuel cells is actually performed in advance of a steam reforming reaction using this new highly efficient devulcanizing agent. Since the engine performance of the devulcanizing agent was improving remarkably as a result of constituting and evaluating the fuel cell system which processes reformed gas according to a denaturation catalyst if needed, and is made into the heating gas for hydrogen inclusion fuel cells, the activity of catalysts, such as a latter steam-reforming catalyst, was fully demonstrated, and it was checked that a catalyst life is also prolonged remarkably. Moreover, in the case of this devulcanizing agent, since effect with the amount used is efficient also in a small quantity was demonstrated, it also became clear miniaturization of a fuel cell system and that it could plan easily. This invention persons came to complete this invention mainly based on these knowledge and data.

0014] That is, this invention offers the desulfurization method of the hydrocarbon raw material for fuel cells characterized by making the devulcanizing agent which consists of copper, nickel, and zinc oxide which preceded reforming to the heating gas of a hydrogen principal component, and manufactured the hydrocarbon raw material by the coprecipitation method by the steam reforming reaction contact.

0015] This desulfurization method converts various kinds of hydrocarbons into the reformed gas of a hydrogen principal component by a steam reforming reaction. In various kinds of fuel cell systems of a type which carry out denaturation treatment if needed, and convert and use this reformed gas for the hydrogen inclusion heating gas for fuel cells It can use suitably as a means to fully remove sulfur content from the hydrocarbon inclusion raw material (namely, hydrocarbon raw material for fuel cells) used for manufacture of the hydrogen inclusion heating gas. In addition, this desulfurization treatment is carried out in advance of a steam reforming reaction in that case.

0016] [that sulfur content should fully be removed from said hydrocarbon raw material] in the desulfurization method of this invention The devulcanizing agent (hereafter, in order to distinguish this from a general devulcanizing agent, it may be called a devulcanizing agent [A]) which consists of said specific devulcanizing agent, i.e., the copper manufactured with the coprecipitation method, nickel, and zinc oxide at least is used.

0017] Preparing with a coprecipitation method is important for this devulcanizing agent [A], and, generally it can be suitably obtained by the method shown below.

0018] Namely, in order to manufacture this devulcanizing agent [A] First, it is made to form by making the suitable precipitant for the aqueous solution of these raw material metallic compounds act, and carrying out the coprecipitation of the precipitate which consists of a copper component, a nickel component, and a zinc component at least (in addition, the detail of the raw material metallic compounds which use this precipitate for formation, a precipitant, and a coprecipitation method is mentioned later.). Thus, after ripening this precipitate made to generate with a coprecipitation method if needed, according to ** etc., it dissociates from liquid and it is washed if needed. Thus, a grain-like solid is usually obtained. In this way, as for the obtained solid, it is desirable to usually calcinate at a suitable temperature (preferably 300-600 degrees C) temperature after desiccation at a suitable

temperature (preferably 100-120 degrees C). In addition, as for this calcination, it is usually desirable to carry out in an air current. Furthermore, it is desirable to fabricate and use of suitable size the solid of the shape of a grain, such as a calcination object obtained by having carried out in this way, with tableting shaping etc., after adding additives, such as graphite, if needed.

0019] The precursor of the devulcanizing agent [A] made into the object as mentioned above can be manufactured suitably. In this way, this obtained precursor usually consists of copper oxide, nickel oxide, and zinc oxide at least. Said target devulcanizing agent [A] is a temperature (preferably) suitable in reducing gas atmospheres, such as hydrogen, carbon monoxide, or these mixed gas, about the precursor of the shape of this multiple oxide, for example. Reduction treatment is carried out at the temperature of 200-500 degrees C, it can return to a metallic state and copper oxide and nickel oxide can be obtained by considering it is copper-nickel zinc oxide, respectively. You may perform this reduction by diluting reducing gas with inert gas, such as nitrogen, suitably. In addition, this reduction treatment may be performed in the desulfurization reactor in a fuel cell system, and you may carry out separately beforehand.

0020] [each metallic compounds (a copper compound, a nickel compound, and zinc compound) which it faces manufacturing this devulcanizing agent [A], and are used for formation of the precipitate by said coprecipitation method] if a predetermined aqueous solution is obtained and a coprecipitation method is presented, there will be no restraint in particular, for example, a variety of compounds will use organic acid salts, such as inorganic acid salts, such as nitrate, sulfate, and a chloride, and acetate, alkoxide, an ammine complex, etc. -- it is possible. Also in these, copper nitrate, nickel nitrate, and zinc nitrate are used specially preferably.

0021] Although ** which a restraint in particular does not have on the other hand as said precipitant used for formation of the precipitate by said coprecipitation method, and selects and uses a suitable thing suitably according to other conditions, such as a class of raw material metallic compounds to be used and a presentation of the aqueous solution, is good. Usually, a hydroxide or carbonate of alkali metals, such as sodium and potassium, or an alkaline earth metal element etc. is used suitably, and these can be used as remaining as it is or an aqueous solution. Moreover, aqueous ammonia etc. is used suitably.

0022] In addition, said coprecipitation methods are raw material metallic compounds (in this case) to be used like [in the case of a general coprecipitation method]. The class of a copper compound, a nickel compound, and zinc compound, and the presentation of the aqueous solution, According to the class and its type of usage (or [For example,] it adds [whether it adds as an aqueous solution, or] as it is, **) of the precipitant added or mixed, the mixed method of the aqueous solution of metallic compounds, and a precipitant, etc., various modification occurs and various kinds of methods can be applied. Although the aqueous solution in which copper nitrate, nickel nitrate, copper compounds, such as an aqueous solution which dissolved zinc nitrate, the nickel compound, and the zinc compound are generally dissolved, for example is prepared, precipitants, such as an aqueous solution of sodium carbonate, are mixed to this, for example and the method of carrying out a coprecipitation is adopted suitably. Various modification, such as a method which is not necessarily limited to the method of using the aqueous solution containing three kinds of metal components of such a copper compound, a nickel compound, and a zinc compound, and mixes copper nitrate, ammonia nature aqueous solutions, such as nickel nitrate, and the aqueous solution of zinc nitrate, is possible.

0023] With an above coprecipitation method, said devulcanizing agent [A] which consists of copper, nickel, and zinc oxide at least can be obtained suitably. [in addition, the rate of the copper component in this devulcanizing agent [A], a nickel component, and a zinc component] It is usually appropriate [(1-3):(1-5):(3-7)] and to select preferably in the range of [(0.5-2.0):(2.0-4.0):(5.0-7.0)] at an atomic ratio [Cu:nickel:Zn].

0024] In the desulfurization method of this invention, it desulfurizes by contacting a predetermined hydrocarbon raw material (various kinds of hydrocarbon raw materials for fuel cells) on the suitable reaction conditions for the devulcanizing agent [A] manufactured as mentioned above, and the sulfur content contained in this raw material is fully removed.

0025] As a hydrocarbon raw material with which desulfurization is presented here, it can be

imed at the hydrocarbon system raw material of one sort or the various presentations which re contained two or more sorts of the hydrocarbon which can be converted into the heating as of a hydrogen principal component by a steam reforming reaction. Usually, one sort or he hydrocarbon system raw material (what uses alkane as a principal component preferably) ontained two or more sorts is suitably used in various kinds of hydrocarbons in various inds of boiling ranges from methane to a gas oil fraction. Such a hydrocarbon raw material s not limited to the thing of a petroleum system, and can apply the thing of various systems, uch as a thing of a natural gas system, and a thing of a Carboniferous system. As what can e especially used conveniently also in these For example, the hydrocarbon inclusion gas hich uses comparatively low-grade alkane, such as methane, ethane, propane, and butane, s a principal component, natural gas or LNG, various kinds of town gas, LPG, naphtha, erosene, and various gas oil can be illustrated. In addition, the sulfur content may be educed by hydrodesulfurization beforehand usual in these hydrocarbon raw material.

0026] In this desulfurization method, as concentration of the sulfur content contained in the aw material with which said desulfurization is presented, it is the weight basis converted nto Sulfur S, and what is in the range of 5-65 ppm preferably 0.1-100 ppm usually serves as . suitable object. Here, as sulfur content, these raw materials may contain only an rganosulfur compound (mercaptan is sufficient.), may contain only hydrogen sulfide, and, f course, may contain both both.

0027] Desulfurization treatment performed using said devulcanizing agent [A] can usually e suitably carried out according to the reaction conditions shown below.

0028] In addition, when it contains an organosulfur compound in the raw material to supply, s for this desulfurization treatment, it is usually desirable to carry out under coexistence of ydrogen. That is, the devulcanizing agent [A] manufactured with the coprecipitation method s mentioned above has the high chemical-absorption ability to sulfur content (especially ydrogen sulfide). On the other hand, as sulfur content, when it contains only hydrogen ulfide, necessarily not adding hydrogen can also fully remove this by an adsorption reaction. herefore, what is necessary is to add hydrogen and just to present desulfurization treatment cording to a case. In that case, what carried out easy separately may be used for hydrogen r hydrogen containing gas to add, it may recycle and divert a part of hydrogen contained in he product after a latter steam reforming reaction, or hydrogen containing gas, and is good lso by such combination.

0029] It is usually suitable for the reaction temperature in this desulfurization treatment referably to select [280-380-degree C] in the range of 330-360 degrees C.

0030] It is usually suitable for reaction pressure G and 1.0-10.0kg/cm² of to select 5.0-6.0kg/ m² in the range of G preferably.

0031] It is usually suitable for the space velocity of feed 0.1 - 2.0h⁻¹, and to select in the ange of 0.2 - 1.0h⁻¹ preferably as liquid space velocity (LHSV) calculated from the volume n case the hydrocarbons in the volume of the appearance of the devulcanizing agent [A] to e used and feed are liquefied.

0032] In addition, it is suitable for the addition rate of hydrogen that more than equimolar usually selects preferably to the sulfur content (sulfur S) contained as an organosulfur ompound in a raw material in the range of 0.05 - 0.5H₂ and NI / kerosene, and g.

0033] Although there is no restraint in particular as a reaction method in this desulfurization eatment, the continuation flow method by a fixed bed method is usually used suitably.

0034] The sulfur content in a raw material (an organosulfur compound and hydrogen ulfide) can fully be easily reduced to low concentration as mentioned above, and the ydrocarbon inclusion product for low sulfur suitable as a raw material of the steam eforming reaction in a fuel cell system can be acquired efficiently. In addition, sulfur ontent is the weight basis converted into Sulfur S, and decreasing to 0.1 ppm or less is usually desirable, and it can obtain easily the suitable hydrocarbon inclusion object for the team reforming reaction for such low sulfur by this desulfurization method.

0035] Namely, since sulfur content can fully be efficiently reduced from various kinds of ydrocarbon raw materials for fuel cells to low concentration by applying the desulfurization ethod of this invention in advance of the conventional steam reforming reaction in a fuel ell system Lowering of the activity of a subsequent steam-reforming catalyst or a lenaturation catalyst can be controlled remarkably, and a catalyst life can also be made to

ncrease remarkably. Moreover, since the devulcanizing agent [A] used for this method is remarkably excellent in that desulfurization engine performance compared with the conventional devulcanizing agent, that amount used can also be lessened all the time, herefore the desulfurization facility ***** can realize miniaturization of a fuel cell system easily.

0036] In addition, can perform a latter steam reforming reaction and denaturation treatment by a method as usual, and the desulfurization process by this devulcanizing agent [A] is only incorporated as a desulfurization process of the preceding paragraph of the steam reforming reaction process in the conventional fuel cell system. It becomes possible to constitute the fuel cell system which was superior to before all the time.

0037]

Example] Although the work example of this invention and its comparative example are shown below and this invention is more concretely explained to it, this invention is not limited to these work examples.

0038] 36.2g of work-example 1 copper nitrate (three monohydrates), 130.8g of nickel nitrate (six monohydrates), and 267.7g of zinc nitrate (six monohydrates) It dissolved in ion exchange water and 1.5l. of mixed water solutions of these metal nitrate were prepared, on the other hand, it dissolved in 159g of sodium carbonate (anhydrous salt) ion exchange water, 1.5l. of aqueous solutions of sodium carbonate were prepared, and each aqueous solution was heated at 80 degrees C. Subsequently, after mixing these aqueous solutions quickly, making precipitate form under 80-degree-C churning and completing formation of precipitate, churning was continued for 2 hours and it was made to ripe at 80 degrees C.

0039] Then, by filtration, it dissociated from liquid and the precipitate was washed several times with a proper quantity of ion exchange water. In this way, after drying the obtained solid at 120 degrees C for 12 hours, it calcinated at 450 degrees C among the air air current for 2 hours, and the powdered solid was obtained. The precursor (mean particle diameter of about 5mm) of the devulcanizing agent which carries out tableting molding and which carries out addition mixing, and is made into the object so that this graphite content may become 5 weight % about graphite at this powder was obtained. The devulcanizing agent precursor obtained here was the constituent of the shape of a multiple oxide which consists of copper oxide, nickel oxide, and zinc oxide, and the presentation was Cu:nickel:Zn=1:3:6 in the atomic ratio.

0040] Thus, the thing for which reaction tubing of the continuation negotiation type evaluation test machine for a desulfurization check of the specified quantity is filled up with the devulcanizing agent precursor manufactured with the coprecipitation method, and it is beforehand returned 300 degrees C among a hydrogen air current for 1 hour as shown below After considering it as the target devulcanizing agent (Cu-nickel-ZnO), the continuation negotiation of the mixture of a hydrocarbon raw material and hydrogen was carried out on the following reaction conditions, and the predetermined desulfurization check (acceleration evaluation test) was done on these purifier grids.

0041] (Conditions of an acceleration evaluation test)

Desulfurization test equipment: Continuation negotiation type evaluation test machine (reaction tubing with an inside diameter of 1 inch and a length of 90cm is provided)
The amount of the devulcanizing agent used: 60g (weight as a devulcanizing agent precursor)
Feed hydrocarbon raw material: Kerosene (inclusion sulfur concentration 62 ppm)
Reaction temperature: -- 330 degree-C; reaction pressure: -- 6kg/cm2GLHSV:1h-1; feed H2-/oil ratio: -- the result of this desulfurization check (acceleration evaluation test) is shown in Table 1 0.36 NI/g.

0042] 36.2g of comparative example 1 copper nitrate (three monohydrates) and 130.8g of nickel nitrate (six monohydrates) were dissolved in ion exchange water, 121g of zinc oxide powdered as a carrier was added to the aqueous solution, evaporation to dryness was carried out, the obtained solid was calcinated at 450 degrees C among the air air current for 2 hours, and the powdered solid was obtained. The precursor (mean particle diameter of about 5mm) of the devulcanizing agent which carries out tableting molding and which carries out addition mixing, and is made into the object so that this graphite content may become 5 weight % about graphite at this powder was obtained. The devulcanizing agent precursor obtained here was a supported type constituent with which copper oxide and nickel oxide are supported by

inc oxide, and the presentation was Cu:nickel:Zn=1:3:6 in the atomic ratio.
0043] Thus, this was changed into the devulcanizing agent (Cu-nickel/ZnO in this case) like
he case of a work example 1 using the former type devulcanizing agent precursor
nanufactured by the sinking-in method, and the desulfurization check (acceleration
valuation test) was done on the same conditions as a work example 1 using the this former
ype devulcanizing agent.
0044] The result of this desulfurization check (acceleration evaluation test) is shown in
able 1.
0045] Except having used each commercial catalyst (made by Nissan GADORA) shown in
able 1 as two to comparative example 4 devulcanizing agent, it is the same conditions as a
work example 1, and the desulfurization check (acceleration evaluation test) was done.
0046] The result of these desulfurization checks (acceleration evaluation test) is shown in
able 1.
0047]
Table 1]

	脱硫剤	脱硫生成物中の硫黄濃度 (ppm) (20h後のデータ)
実施例 1	Cu – Ni – ZnO (共沈法)	0.04
比較例 1	Cu – Ni/ZnO (含浸法)	1.0
比較例 2	Cu – ZnO (市販品)	0.13
比較例 3	ZnO (市販品)	4.0
比較例 4	Co – Mo (市販品)	0.4

Analysis of sulfur was based on the electrical quantity measuring method and the electric
conductivity method.
0048] In the work-example 2 work example 1, this was changed into the devulcanizing
gent (Cu-nickel-ZnO) like the case of a work example 1 using the devulcanizing agent
recursor manufactured with the coprecipitation method, and the desulfurization check
acceleration life evaluation test) was done on the same conditions as a work example 1
using this devulcanizing agent.
0049] The result of this desulfurization check (acceleration life evaluation test) is shown in
able 2.
0050]
Table 2]

評価時間	脱硫処理灯油の硫黄分 (ppm)
24	0.1 以下
120	0.1 以下

0051]
Effect of the Invention] The highly efficient devulcanizing agent () which can fully remove
efficiently sulfur content (an organosulfur compound and hydrogen sulfide) from a
hydrocarbon inclusion raw material also with low voltage comparatively in the
desulfurization method of this invention That is, it is since said devulcanizing agent [A]

which consists of copper, nickel, and zinc oxide which were manufactured with the oprecipitation method is developed and the devulcanizing agent is used for this. For example, sulfur content is efficiently removable from various kinds of hydrocarbon raw materials for fuel cells, such as kerosene, gas oil, LPG, town gas, and natural gas. Therefore, lowering of the activity of the steam-reforming catalyst by sulfur content or a denaturation atalyst can be reduced substantially, and those catalyst lives can be made to increase emarkably by preceding presenting a steam reforming reaction with this hydrocarbon raw naterial, and reforming it to the heating gas of a hydrogen principal component, and performing this desulfurization treatment. Moreover, since the desulfurizing ability force is emarkably high compared with the conventional devulcanizing agent, said devulcanizing gent [A] used by the method of this invention can also reduce the amount to be used, and an form architecture of a fuel cell system into Cong Park substantially by this compared with the conventional thing.

0052] namely, -- as the desulfurization means of various kinds of hydrocarbon inclusion raw materials [according to this invention / in / especially / in operating pressure / various kinds of hydrogen-burning type fuel cell systems including the fuel cell system in the case of being omparatively as low as below G grade 10kg/cm2] The outstanding desulfurization method of the hydrocarbon raw material for fuel cells which can be used suitably can be offered.

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Report Mistranlation

Japanese (whole document in PDF)